

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re: Application of HICKS

Serial No. 09/241,511

Examiner:

Filed: February 1, 1999

Group Art Unit: 2834

For: ELECTRICITY GENERATION FOR PEDALLED VEHICLES

CLAIM OF FOREIGN PRIORITY

CERTIFICATE UNDER 37 CFR 1.8(a)

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10000000 Reg. No. 42,984  
Date 3/4/99

Assistant Commissioner for Patents  
Washington, D.C. 20231

Sir:

Priority under the International Convention for the Protection of Industrial Property and under 35 U.S.C. §119 is hereby claimed for the above-identified patent application, based upon United Kingdom Application No. 9802026.6 filed February 2, 1998, and a certified copy of this application is submitted herewith which perfects the Claim of Foreign Priority.

Respectfully submitted,

Date: 3/4/99

Joseph W. Bain

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Docket No. 9100-1

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#21 Priority  
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GAU 2834

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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Serial No. 09/241,511

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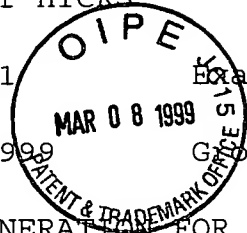
Group Art Unit: 2834

For: ELECTRICITY GENERATION FOR PEDALLED VEHICLES

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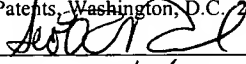
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TRANSMITTAL LETTER

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Reg. No. 42,984

Date 3/4/99

Assistant Commissioner for Patents  
Washington, D.C. 20231

Sir:

Please find enclosed for filing:

- X Claim of Foreign Priority and Certified Priority Document
- X Please charge any deficiencies or credit any overpayment to Deposit Account No. 17-0055.

This Transmittal Letter is submitted in duplicate.

Respectfully submitted,

Date: 3/4/99



Joseph W. Bain

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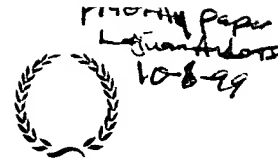
West Palm Beach, FL 33402-3188

Telephone: (561) 653-5000

Docket No: 9100-1

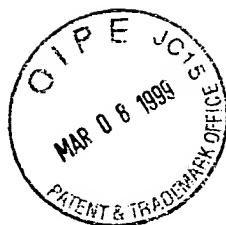


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Concept House  
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the undersigned, being an officer duly authorised in accordance with Section 74(1) and (4) of the Deregulation & Contracting Out Act 1994, to sign and issue certificates on behalf of the Comptroller-General, hereby certify that annexed hereto is a true copy of the documents as originally filed in connection with the patent application identified therein.

in accordance with the Patents (Companies Re-registration) Rules 1982, if a company named in this certificate and any accompanying documents has re-registered under the Companies Act 1980 with the same name as that with which it was registered immediately before re-registration save for the substitution as, or inclusion as, the last part of the name of the words "public limited company" or their equivalents in Welsh, references to the name of the company in this certificate and any accompanying documents shall be treated as references to the name in which it is so re-registered.

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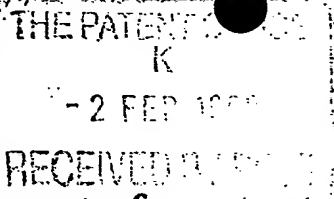
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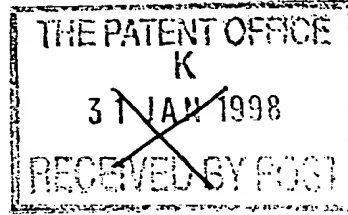
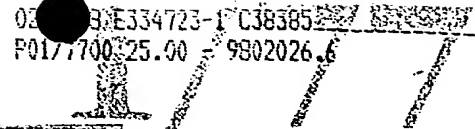
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Dated

23 FEB 1999



The  
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# Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

The Patent Office

Cardiff Road  
Newport  
Gwent NP9 1RH

1. Your reference

HICKS

2. Patent application number

(The Patent Office will fill in this part)

9802026.6

3. Full name, address and postcode of the or of each applicant (underline all surnames)

Inventive Step Limited  
Kemp House  
152/160 City Road  
London EC1V 2HH

Patents ADP number (if you know it)

07371156001

If the applicant is a corporate body, give the country/state of its incorporation

United Kingdom,

4. Title of the invention

"Electricity Generation for Pedalled Vehicles"

5. Name of your agent (if you have one)

Peter Dearing-Lambert

"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode)

P.O. Box 8  
Ibstock  
Leicestershire  
LE67 6PQ

Patents ADP number (if you know it)

04315891002

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and (if you know it) the or each application number

Country

Priority application number  
(if you know it)

Date of filing  
(day / month / year)

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application

Date of filing  
(day / month / year)

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? (Answer 'Yes' if:

- a) any applicant named in part 3 is not an inventor, or
  - b) there is an inventor who is not named as an applicant, or
  - c) any named applicant is a corporate body.
- See note (d))

yes

**Patents Form 1/77**

9. Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document

Continuation sheets of this form	none
Description	6 x 2 /
Claim(s)	2 x 2 /
Abstract	1 x 2 /
Drawing(s)	1 x 2 /

10. If you are also filing any of the following, state how many against each item.

Priority documents

Translations of priority documents

Statement of inventorship and right to grant of a patent (*Patents Form 7/77*)

yes /

Request for preliminary examination and search (*Patents Form 9/77*)

yes /

Request for substantive examination (*Patents Form 10/77*)

no

Any other documents  
(*please specify*)

11. I/We request the grant of a patent on the basis of this application.

Signature

*J. R. Dyce*

Date

Agent for the Applicants 31:01:1998

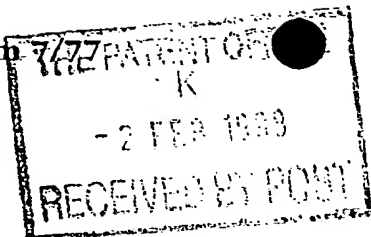
12. Name and daytime telephone number of person to contact in the United Kingdom

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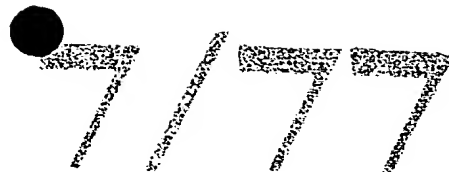
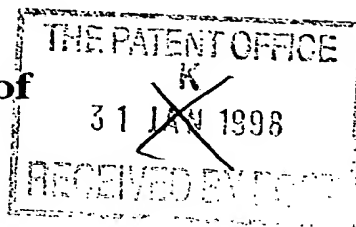
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- If you have answered 'Yes' Patents Form 7/77 will need to be filed.*
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Office



# Statement of inventorship and of right to grant of a patent

The Patent Office

Cardiff Road  
Newport  
Gwent NP9 1RH

1. Your reference

Hicks

2. Patent application number  
(if you know it)

9802026.6

3. Full name of the or of each applicant

Inventive Step Limited

4. Title of the invention

Electricity Generation for Pedalled Vehicles

5. State how the applicant(s) derived the right  
from the inventor(s) to be granted a patent

by virtue of the Inventors employment and special responsibilities

6. How many, if any, additional Patents Forms  
7/77 are attached to this form?  
(see note (c))

one

7. I/We believe that the person(s) named over the page (and on  
any extra copies of this form) is/are the inventor(s) of the invention  
which the above patent application relates to.

Signature

Date 31:01:98

Agent for the Applicants

8. Name and daytime telephone number of  
person to contact in the United Kingdom

Mr. Lambert 01530 262847

## Notes

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- If there are more than three inventors, please write the names and addresses of the other inventors on the back of another Patents Form 7/77 and attach it to this form.
- When an application does not declare any priority, or declares priority from an earlier UK application, you must provide enough copies of this form so that the Patent Office can send one to each inventor who is not an applicant.
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Enter the full names, addresses and postcodes of the inventors in the boxes and underline the surnames

Richard Banfield Hicks  
26 Latchmere Lane  
Kingston  
Surrey  
KT2 5PD

Patents ADP number (if you know it): 00162107001

Patents ADP number (if you know it):

**Reminder**

Have you signed the form?

Patents ADP number (if you know it):

## "ELECTRICITY GENERATION FOR PEDALLED VEHICLES"

This invention relates to electricity generation for pedalled vehicles and more particularly to improvements in the generation of electricity by pedal power and its use in contributing to road safety.

Pedalled vehicles such as bicycles are particularly vulnerable to road accidents not only because they offer little or no protection to the rider but primarily because the drivers of other vehicles may not see them, especially in the dark or poor weather conditions. It is of course mandatory in most countries for bicycles to use lights in the dark and most are equipped with reflectors, but conventional lighting systems leave much to be desired. If lighting is by dry batteries these may fail or the rider may simply fail to turn them on. The drawbacks of conventional generators, either incorporated in a wheel hub or driven by a tyre, include the fact that they make pedalling harder, which is a disincentive to using them, and that the illumination they provide ceases as soon as the bicycle stops, representing a considerable danger e.g. when the bicycle is waiting at traffic lights or at a road junction. Reflectors are of course only effective when illuminated by the oncoming vehicle, which will not occur if the latter has no adequate lights or is approaching at an angle.

In recent years LEDs (light emitting diodes) have been used either instead of or to supplement light bulbs. Taking advantage of their relatively low power consumption it is practicable to have them permanently in use, even in daylight. Flashing LEDs attract attention and it has been appreciated that it is particularly advantageous to mount them upon the pedals. Their rotary motion attracts attention and moreover an oncoming driver can judge his orientation relative to the bicycle by whether the rotating LEDs describe a circle (when at right angles) a vertical line (when in front or behind) or an ellipse when approaching at an angle. Direction can of course be judged by the colour of the visible LEDs, usually red indicating the rear of the bicycle and a white or green light indicating that it is approaching.

While the use of LEDs on the pedals of a bicycle is highly advantageous, if their power is derived from a dry battery this may fail unbeknownst to the rider and in any event the use of dry batteries is undesirable if it can be



avoided both because of their high cost and the environmental problems associated with their disposal.

Japanese Patent Publication No. 07291174A and United States Patent No. 5662405 propose the modification of a bicycle pedal to serve as a generator of electricity to illuminate LEDs mounted on the frame or tread portion of the pedal. Permanent magnets are attached to the pedal shaft or spindle and the pedal frame or tread portion is provided with windings or solenoids and relative rotation between the permanent magnets and the windings as relative rotation occurs between the pedal spindle and tread portion generates current by magnetic induction on the same principles as in the case of a conventional bicycle dynamo.

The voltage generated by an inductance generator is a function of the number of windings of the stator and the speed of rotation of the rotor. The essential weakness of a system such as described in the said Japanese patent publication resides in the relatively very low speed of rotation of the rotor or spindle under normal circumstances. A pedal spindle will rotate only once relative to the tread portion or frame mounted upon it for every revolution of the crank on which the spindle is mounted. A cyclist typically will pedal at between 30 and 60 revolutions of the pedal crank per minute. Japanese Patent publication No. 07291174A recognises this problem but the only solution proposed is to increase the number of windings. The present Applicants have calculated that this is impracticable because it would increase unacceptably the cost and/or size of the stator component, bearing in mind that this is to be incorporated in the tread portion of a pedal.

Another disadvantage of using the pedal spindle itself as the rotor is that it, and the associated bearings, will be subjected to the wear and abuse in service which pedal spindles usually experience. It is preferable that the relatively delicate and accurate bearings of a generator should not be directly exposed to such treatment.

A principal object of the present invention is to improve upon the proposals of the said Japanese Patent publication and offer solutions to the problems associated therewith.

In accordance with the invention there is provided electricity generating apparatus for a vehicle equipped with pedals, such as a bicycle, wherein at least one said pedal comprises a spindle and a tread portion relatively rotatable about the spindle, electricity generating means mounted upon the tread portion and transmission means between the spindle and generator such that for each revolution of the spindle relative to the tread portion the generator undergoes more than one revolution.

Preferably the rotor of the generator is rotatably mounted within the tread portion to rotate about an axis generally parallel with that of the spindle and the generator preferably comprises stator means generally parallel with the spindle and stationary relative to the tread portion.

The transmission means may drive the rotor of the generator via gears at one end of the generator stator.

The transmission means may comprise meshing gear wheels of unequal diameter one of which is stationary relative to the spindle and the other of which drives the rotor of the generator or it may comprise pulleys of unequal diameter one of which is stationary relative to the spindle and the other of which drives the rotor of the generator, said pulleys being connected by an endless belt. The ratio of said gear wheels or of said pulleys is preferably of the order of 2:1.

The said gears are preferably included in a gear box which has a 5:1 output ratio.

The generator and gear box may be arranged in longitudinal alignment within the tread portion on one side of the spindle and a capacitor may be arranged within the tread portion on the opposite side of the spindle, the capacitor being arranged to store electricity generated by the generator.

One or more arrays of LEDs may be mounted on the tread portion and arranged to be energised by electricity generated by the generator. LEDs exposed to view at one side of the tread portion may differ from LEDs exposed at the opposite side of the tread portion and the weight of the tread portion may be different on opposite sides of the spindle such that it adopts a non-horizontal attitude before a foot is placed upon it. Alternatively, or in

addition, the underside of the tread portion may have an outward projection. In this way a cyclist can determine whether a pedal tread portion is the right way round or not (i.e. to offer the correct LED displays in the correct directions) when putting a foot on it. The said difference between the LEDs may be one of colour, number, distribution or any combination of these.

The arrangement is preferably such that the generator has an output of approximately 2 volts when relative rotation between the spindle and tread portion is 30 rpm.

A preferred embodiment of the invention will now be described with reference to the accompanying Drawings, in which:

Figure 1 is a longitudinal section through a bicycle pedal assembly in accordance with the present invention,

Figure 2 is a sectional elevation taken on the line II-II of Figure 1, and Figure 3 is a sectional elevation taken on the line III-III of Figure 1.

The bicycle pedal 20 illustrated in Figure 1 is designed to extend at one end 21 from a crank (not shown) of a bicycle. As is well known per se the bicycle has a second crank similarly equipped with a pedal at 180° to the first, and by placing one foot on each pedal and rotating the cranks the cyclist propels the machine. The pedal comprises a shaft or spindle 1 which will be stationary relative to the associated crank and upon which is mounted a frame or tread portion 2 to be relatively rotatable by means of bearings 22 and 23. With a cyclist's foot resting on it the tread portion 2 will be held in a horizontal attitude and so for each full revolution of the crank there is one full revolution of the spindle 1 relative to tread portion 2. As so far described the pedal 20 is conventional so that no further description is considered necessary.

In accordance with the present invention, however, there is disposed at the distal end of the spindle 1 and stationary with respect thereto a pulley 4 which is connected by an endless belt 6 to a smaller pulley 5 with a ratio of 2:1. The pulley 5 is at one end of and drives the gears of a gear box 7 which in turn drives the rotor of a generator 3, the gear box having the effect that the rotor of the generator 3 is rotated at five times the speed

of the pulley 5. The assembly of gear box 7 and generator 3 is a proprietary product readily available on the market so that no further description thereof is considered necessary. It is housed within the tread 2 on one side of the spindle 1. Housed in the tread 2 on the opposite side of the spindle is a capacitor 8 which is arranged to store electricity generated by the generator 3 so as to continue to energise an array 9 of LEDs, if for only a short time, after the generator ceases to rotate either because the bicycle is stationary or because the cyclist is free-wheeling.

It will be seen that by this arrangement for each full rotation of the crank, and with the tread 2 held horizontal by a foot placed upon it, there will be one full revolution of the pulley 4 relative to the tread 2 and in consequence the rotor of the generator will be rotated at a speed which is a multiple of the speed of rotation of the crank, typically 300 rpm when the rate of rotation of the crank is between 30 and 60 rpm. A speed of rotation of the rotor of the generator of 300 rpm is sufficient to output 2 volts or more, this being the minimum required simultaneously to energise the LEDs 9 and charge the capacitor 8.

The array 9 of LEDs is housed in a lens 13 at the distal end of the pedal tread portion 2 and mirrored surfaces 12 within the lens are arranged to project light beams in the fore and aft direction as well as laterally outwardly of the bicycle. In accordance with an optional feature of the invention the light emitted rearwardly is red and the light emitted forwardly and laterally is a different colour, so that the drivers of other vehicles will know in which direction the bicycle is travelling. To prevent placing a foot on the pedal with the tread the wrong way round (i.e. so that red light shows forward) the pedal has a projection 15 on its underside which will alert a rider if he places his foot on it and/or the assembly 37 is of greater weight than the capacitor 8 so that the pedal assumes a non-horizontal attitude when there is no foot upon it. When mounting the bicycle the rider will know that the pedal should be tilting backward rather than forward before placing a foot upon it.

It will be evident that both pedals of the same bicycle or other pedal driven or pedal equipped vehicle may similarly be provided with electricity generating and/or capacitor and/or LED means. It will also be evident

that the electricity generated by the generator 3 might be used instead or additionally to energise some other device such as a sonic alarm.

The present invention provides for the first time a practicable way of achieving that a bicycle or the like will be provided with a lighting or other alarm or alerting system which does not rely either upon batteries or upon the rider remembering to switch it on. The system is an in-built and foolproof safety feature which could be made mandatory for bicycles without unacceptably increasing their cost or having implications for the environment such as arise from the use of batteries. A further advantage is that pedals according to the invention may be offered as replacement or "retro fit" items, so that existing machines can be equipped with them at little cost as well as new ones.

## CLAIMS:

1. Electricity generating apparatus for a vehicle equipped with pedals, such as a bicycle, wherein at least one said pedal comprises a spindle and a tread portion relatively rotatable about the spindle, electricity generating means mounted upon the tread portion and transmission means between the spindle and generator such that for each revolution of the spindle relative to the tread portion the generator undergoes more than one revolution.
2. Apparatus as claimed in claim 1, wherein the rotor of the generator is rotatably mounted within the tread portion to rotate about an axis generally parallel with that of the spindle.
3. Apparatus as claimed in either preceding claim, wherein the generator comprises stator means generally parallel with the spindle and stationary relative to the tread portion.
4. Apparatus as claimed in any one of the preceding claims, wherein the transmission means drives the rotor of the generator via gears at one end of the generator stator.
5. Apparatus as claimed in any one of the preceding claims, wherein the transmission means comprises meshing gear wheels of unequal diameter one of which is stationary relative to the spindle and the other of which drives the rotor of the generator.
6. Apparatus as claimed in any one of claims 1 - 4, wherein the transmission means comprises pulleys of unequal diameter one of which is stationary relative to the spindle and the other of which drives the rotor of the generator, said pulleys being connected by an endless belt.
7. Apparatus as claimed in claim 5 or claim 6 wherein the ratio of said gear wheels or of said pulleys is of the order of 2:1.
8. Apparatus as claimed in claim 7 as appendant to claim 4, wherein the gears are included in a gear box which has a 5:1 output ratio.

9. Apparatus as claimed in claim 8, wherein the generator and gear box are arranged in longitudinal alignment within the tread portion on one side of the spindle and a capacitor is arranged within the tread portion on the opposite side of the spindle, the capacitor being arranged to store electricity generated by the generator.

10. Apparatus as claimed in any one of the preceding claims and comprising one or more arrays of LEDs mounted on the tread portion and arranged to be energised by electricity generated by the generator.

11. Apparatus as claimed in claim 10 as appendant to claim 9, wherein LEDs exposed to view at one side of the tread portion differ from LEDs exposed at the opposite side of the tread portion and wherein means is provided to encourage the selection of a particular orientation of the pedal when a foot is placed upon it.

12. Apparatus as claimed in claim 11 wherein the said difference is in colour, number and/or distribution.

13. Apparatus as claimed in claim 11 or claim 12, wherein the weight of the tread portion is different on opposite sides of the spindle such that it adopts a non-horizontal attitude before a foot is placed upon it.

14. Apparatus as claimed in any one of claims 11 - 13, wherein the underside of the pedal has a projection.

15. Apparatus as claimed in any one of the preceding claims wherein the arrangement is such that the generator has an output of approximately 2 volts when relative rotation between the spindle and tread portion is 30 rpm.

16. Electricity generating apparatus for a vehicle equipped with pedals, such as a bicycle, substantially as hereinbefore described with reference to and as shown in the accompanying Drawings.

## ABSTRACT

(Fig. 1)

**"ELECTRICITY GENERATION FOR PEDALLED VEHICLES"**

A generator 3 mounted within the tread portion 2 of a pedal 20 of a bicycle or the like is driven via pulleys 4 and 5 of unequal diameter and a gear box 7 so that the speed of rotation of the rotor of the generator is a multiple of the speed of relative rotation between the spindle 1 of the pedal and the tread portion 2 when the latter is held horizontal by a foot resting on it and the crank (not shown) from which the spindle 1 extends is rotated to propel the bicycle. The gearing up of the generator enables sufficient output voltage to illuminate an array 9 of LEDs and charge a capacitor 8 which will keep them illuminated while the pedal is temporarily stationary.



